INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTION FORM

Course Title	OPERATING SYSTEMS			
Course Code	A50510			
Regulation	R15 – JNTUH			
Academic Year	2017-18			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Coordinator	Mrs.B.Dhanalaxmi, Associate Professor, IT			

I. COURSE OVERVIEW:

This course provides a comprehensive introduction to operating system design concepts, data structures and algorithms. The course is designed to provide in-depth critique on the problems of resource management and scheduling, concurrency and synchronization, memory management, file management, peripheral management, protection and security. This course is intended to discuss the topics in a general setting not tied to any one particular operating system. Throughout the course, the study of practical aspects that pertain to the most popular operating systems such as Unix/Linux and Windows are considered as case studies.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	5	Data Structure and Algorithms, Computer Architecture

III. M
MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking.	75	100

Sessional Marks	University End Exam marks	Total marks
Marks shall be awarded considering the average of two midterm tests in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES:

1 **Understand** basic concepts of Operating Systems and its objectives.
2 **Master** the concepts of processes, inter-process communication, synchronization and scheduling.
3 **Analyze** the performance of memory management techniques in various real-time scenarios.
4 **Master** the concepts of data input/output, storage and file management
5 **Distinguish** the techniques for deadlock detection, prevention and recovery.

VI. COURSE OUTCOMES:

At the end of the course the students are able to:

1 **Understand** the difference between process & thread, issues of scheduling of user-level processes/ threads and their issues
2 **Use** modern operating system calls and synchronization libraries in software or hardware interfaces**.**
3 **Infer** the performance of page replacement algorithms in various scenarios.
4 **Recognize** the issues related to file system interface and implementation, disk management.
5 **Understand** the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Tutorials
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Mini Projects
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Projects
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	N	--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	N	--
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Lectures, Projects

N - None **S - Supportive** **H - Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.	H	Lectures, Assignments
PSO2	**Software Engineering Practices:** The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success.	H	Projects
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.	S	Guest Lectures

N - None S - Supportive H - Highly Related

IX. SYLLABUS:

UNIT - I

Operating System Introduction: Operating Systems objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time systems, Special-Purpose Systems, Operating System services, User OS interface, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, OS Structure, Virtual Machines.

UNIT – II

Process and CPU Scheduling - Process Concepts-The Process, Process State, Process Control Block, Threads, Process Scheduling-Scheduling Queues, Schedulers, Context Switch, Preemptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Thread Scheduling, Case Studies: Linux, Windows.

Process Coordination-Process Synchronization, The Critical Section Problem, Peterson's solution, Synchronization Hardware, Semaphores, and Classic Problems of Synchronization, Monitors, Case Studies: Linux, Windows.

UNIT – III

Memory Management and Virtual Memory – Logical & Physical Address Space, Swapping, Contiguous Allocation, Paging, Structure of Page Table, Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Performance of Demanding Paging, Page Replacement, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT – IV

File System Interface – The Concept of File, Access methods, Directory Structure, File System Mounting, File Sharing, Protection, File System Implementation – File System Structure, File System Implementation, Allocation methods, Free-Space Management, Directory Implementation, Efficiency and Performance.

Mass Storage Structure – Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, and Swap space Management.

UNIT – V

Deadlocks – System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.

Protection – System Protection, Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection.

Text books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Principles", 8e, Wiley Student Edition.
2. W. Stallings, "Operating Systems - Internals and Design Principles", 6e, Pearson.

References:

1. S. Godbole, "Operating Systems", 2e, TMH.
2. P. C. P. Bhatt, "An Introduction to Operating Systems", PHI.
3. S. Haldar and A. A. Aravind, "Operating Systems", Pearson Education.
4. T. W. Doeppner, "Operating Systems in Depth", Wiley.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1 - 2	**Operating System Introduction:** Operating Systems Objectives & Functions, Computer System Architecture, OS Structure And Operations	**Understand** the importance of OS and its functions	T2: 2.1 T1: 1.1 - 1.5
3 - 4	Evolution of Operating Systems – Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time systems, Special-Purpose Systems	**Associate** the types of operating systems with real-life applications	T2: 2.2
5 - 6	OS Services, User OS Interface, Systems Calls, Types of Systems Calls, System Programs	**Interpret** the OS services and system calls	T1: 2.1 - 2.5
7 - 8	OS Design & Implementation, OS Structure, Virtual Machines	**Explain** the benefits of building abstract layers in hierarchical fashion and virtualization	T1: 2.6 - 2.8
9 - 10	**Process & CPU scheduling:** Process Concepts, Process Scheduling - Scheduling Queues, Schedulers, Context Switch, Preemptive Scheduling, Dispatcher	**Compare** and **contrast** the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating Systems	T1: 3.1 - 3.4 T2: 3.1 - 3.4
11 - 13	Scheduling Criteria, Scheduling Algorithms		T1: 5.2 - 5.3
14	Multiple Processor Scheduling, Real-Time Scheduling	**Examine** appropriate scheduling algorithm for real-life applications	T1: 5.5 T2:10.1-10.2

15	Thread Scheduling	**Infer** advantages of threads over Processes	T1: 5.4
16	Case Studies - Linux, Windows	**Associate** the process management in real operating systems	T1:5.6, 21.4 T2: 8.3 - 8.5
17 - 19	**Process coordination:** Process Synchronization, The Critical - Section Problem, Peterson's Solution, Synchronization Hardware	**Summarize** the range of mechanisms that can be employed at the operating system level to realize concurrent systems and describe the benefits of each.	T1: 6.1 - 6.4
20 - 21	Semaphores & Classical Problems of Synchronization, Monitors	**Understand** classical problems of synchronization	T1: 6.5 - 6.7
22	Case Studies: Linux, Windows	**Discuss** process synchronization in real operating systems	T2: 6.7 - 6.8, 6.10
23 - 24	Memory Management & Virtual Memory: Logical & Physical Address Space, Swapping, Contiguous Memory Allocation	**State** basics of memory management	T1: 8.1 - 8.3
25 - 26	Paging, Structure of Page Table	**Demonstrate** the concepts of memory management such as paging and segmentation	T1: 8.4 - 8.5
27	Segmentation, Segmentation with Paging		T1: 8.6
28 - 29	Virtual Memory, Demand Paging, Performance of Demand Paging	**Illustrate** the benefits of virtual memory and demand paging	T1: 9.1 - 9.2
30 - 32	Page Replacement, Page Replacement Algorithms	**Order** the page replacement algorithms according to their performance	T1: 9.4
33	Allocation of Frames, Thrashing		T1: 9.5 - 9.6
34	File system Interface: Concept of File, Access Methods, Directory Structures	**Summarize** the full range of considerations that support file Systems. Compare and contrast different approaches to file organization, recognizing the strengths and weaknesses of each.	T1:10.1-10.3
35 - 36	File System Mounting, File Sharing, Protection, File System Structure, Implementation	**Outline** the issues of file system implementation	T1:10.4-10.6 T1:11.1-11.2
37 - 38	File Allocation Methods	**Define** file allocation methods and performance metrics	T1: 11.4
39 - 40	Free-Space Management, Directory Implementation, Efficiency and Performance	**Outline** the issues of file system implementation	T1: 11.3, 11.5 -11.6
41 - 42	Mass Storage Structure:	**Distinguish** between various	T1:12.1-2.4

	Overview, Disk Structure, Disk Attachment	techniques for disk management	
43 - 44	Disk Scheduling and Management, Swap-Space Management	**Explain** conditions that lead to deadlock and differentiate between deadlock, starvation, and race conditions.	T1:12.5-12.6
45	Deadlocks: System Model, Deadlock Characterization		T1: 7.1 - 7.2
46 - 48	Methods of Handling Deadlocks, Deadlock Prevention and Avoidance	**Understand** the difference between Preventing and avoiding deadlocks.	T1: 7.3 - 7.5
49 - 50	Dead Lock Detection, Recovery from Deadlock		T1: 7.6 - 7.7
51 - 52	Protection: System Protection, Goals of Protection, Principles of Protection, Domain of Protection	**Quote** the goals and principles of system protection	T1:14.1-14.3
53 - 54	Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights	**Clarify** the different types of access control	T1:14.4-14.7
55 - 56	Capability- Based systems, Language - Based Protection	**Match** appropriate protection system for the needs of the system.	T1:14.8-14.9

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H				H							H	S		
II		S			S									H	
III	S											H			H
IV		H			S								S		S
V	H				S							S		S	

S - Supportive **H - Highly Related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H				H							H	S		
II					S							S		S	
III	S	H													H
IV		H			S							H	H		S
V	H				S							S		S	

S - Supportive **H - Highly Related**

Prepared by: Mrs.B.Dhanalaxmi, Associate Professor, IT
Date **:** 01-07-2017

HOD, IT